NASA/GSFC Raman Lidar Group - Graduate Research Opportunities

The NASA/Goddard Space Flight Center Raman Lidar group has an international reputation in the use of lidar for understanding the earth's atmosphere. The group's expertise ranges from initial system design to analysis of atmospheric processes using the data. Research opportunities exist for talented students to pursue their graduate research with the NASA/GSFC Raman lidar group. Research efforts can be focussed either on analysis of atmospheric data or lidar technology development or a combination of both. Students will be able to work with NASA scientists in NASA laboratories and at field sites during intensive atmospheric research experiments.

The Raman group has activities in both ground-based and airborne instruments. The ground-based Scanning Raman lidar was first deployed in 1991 and provides numerous opportunities for student research. Also, a new airborne Raman lidar instrument is being developed under NASA's instrument incubator program. There are currently opportunities for student research in the development of this new instrument in the areas of lasers, fiber optics, Fabry-Perot etalons, miniature photo detectors, computer automated instrument control, etc.

The Scanning Raman Lidar

The Scanning Raman Lidar (http://virl.gsfc.nasa.gov/srl/index.htm) is a state of the art research facility and the Raman group's main instrument. Contained in a single mobile trailer, this instrument measures atmospheric water vapor, aerosols, clouds, and temperature. It has participated in field experiment campaigns located in Kansas, coastal Virginia, Oklahoma and the Bahamas. The SRL as deployed to Andros Island in the Bahamas is shown in figure 1.

Figure 1 Scanning Raman Lidar as deployed at Andros Island in the Bahamas for the third Convection and Moisture Experiment (CAMEX3); a hurricane study program which occurred August - September, 1998.

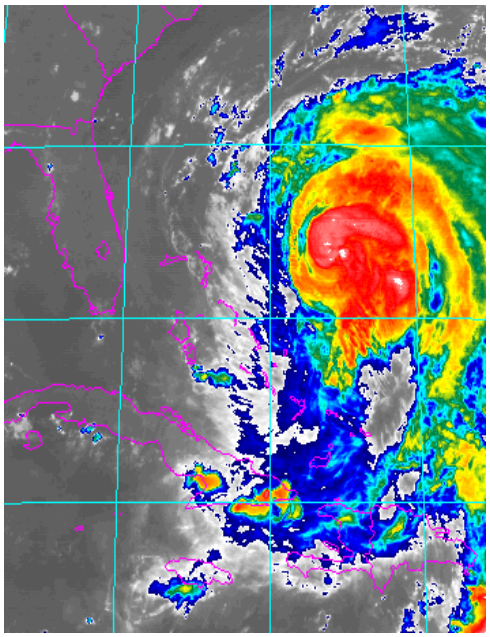

Figure 2. GOES-8 IR image of hurricane Bonnie at its point of closest approach to Andros Island, Bahamas on August 24, 1998

During this deployment, extensive measurements were made of the water vapor and aerosol environment of hurricane Bonnie. Figure 2 shows a satellite photo of Bonnie during its closest approach to Andros Island on August 24, 1998. This close approach has allowed numerous atmospheric processes to be studied including the evolution of water vapor in the hurricane environment, the evolution of cirrus cloud structure and optical depth during the passage of Bonnie and also unique measurements of

water vapor during rainfall associated with one of the feeder bands of Bonnie. These rain measurements are shown in figure 3.

These measurements during rainfall demonstrate the ability of the SRL to measure important atmospheric quantities such as cloud base location, water vapor mixing ratio and aerosol scattering ratio during a rain event. This is only possible due to the Raman system's use of pure molecular scattering to make its measurements.

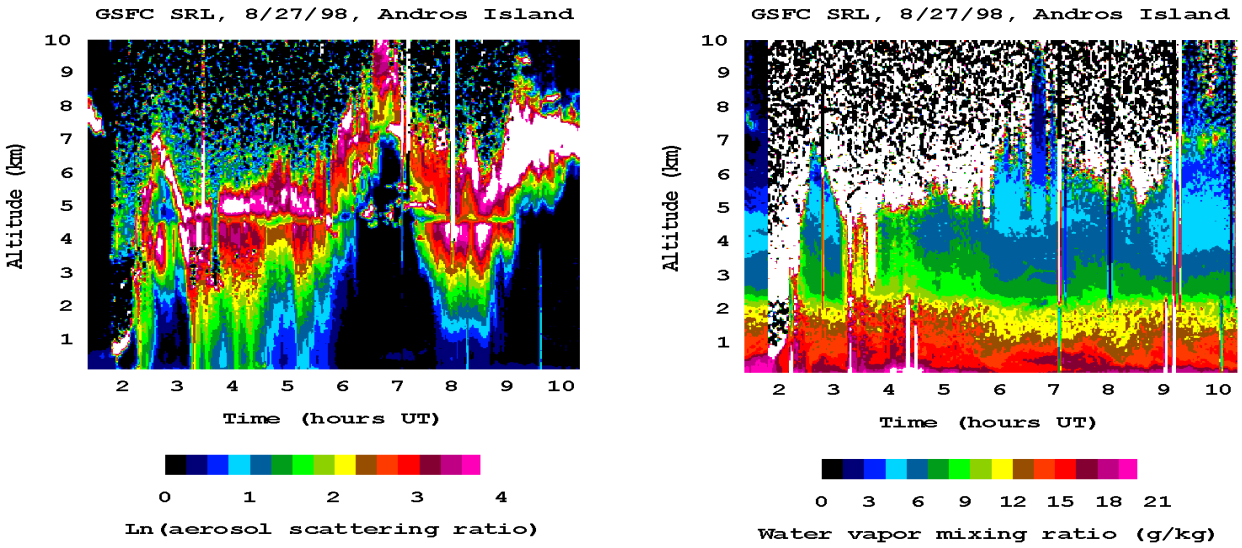

Figure 3. Raman lidar measurements of aerosols (left) and water vapor mixing ratio (right) during a rainstorm associated with one of the feeder bands of hurricane Bonnie. This demonstrates the unique capability of the Raman lidar to acquire useful atmospheric data even during rain storms.

Raman Airborne Spectroscopic Lidar - RASL

Under NASA's Instrument Incubator Program, the NASA/GSFC Raman Lidar group has been funded to develop a new airborne Raman lidar. This new instrument will advance the state of the art in airborne remote sensing of the atmosphere by permitting measurements of water vapor, aerosols, clouds, liquid water and temperature to be performed. It will be developed in the Raman lidar lab at Goddard Space Flight Center over the next two years with initial laboratory measurements occurring in early 2001.

Contacts

For more information on graduate research opportunities within the NASA/GSFC Raman lidar group, contact Dave Whiteman (david.whiteman@gsfc.nasa.gov, 301 614 6703) or Belay Demoz (demoz@umbc.edu, 301 614 6224).

Publications

The group has published several recent articles in journals such as Applied Optics and Journal of Geophysics Research. There are several others in preparation or under review. Please ask for a list or see our web site (http://virl.gsfc.nasa.gov/srl/index.htm).